

THE IDENTITY OF TWO CLOSELY RELATED AND FREQUENTLY
ENCOUNTERED SPECIES OF NEW WORLD *TRICHOGRAMMA*
(HYMENOPTERA: TRICHOGRAMMATIDAE)

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Abstract.—Most literature references to *Trichogramma perkinsi* (Girault) prior to 1978 are referable to *T. exiguum* Pinto and Platner. All treatments of *T. fasciatum* Perkins as a New World species are incorrect. Material erroneously identified as such represents *T. fuentesi* Torre, a species previously known only from Cuba. *Trichogramma exiguum* and *T. fuentesi* are similar in structure and easily confused. They are best separated by differences in hindwing setation and male genitalic structure.

Recent keys to North American *Trichogramma* (Nagarkatti and Nagaraja, 1971; Nagaraja and Nagarkatti, 1973) differentiate between two closely related species referred to as *T. fasciatum* (Perkins) and *T. perkinsi* Girault. Pinto et al. (1978) determined *T. fasciatum* to be a senior synonym of *T. beckeri* Nagarkatti that had been used inappropriately by recent authors. Similarly, Oatman et al. (1982) noted that *T. perkinsi* was a replacement name for *Pentarthron flavum* Perkins, a distinctive Hawaiian species quite unlike the North American material commonly identified as *T. perkinsi*.

Continuing studies now allow us to clarify the identity of these two species. Populations identified as *T. perkinsi* (e.g., Nagarkatti and Nagaraja, 1971) are assignable to *T. exiguum* Pinto and Platner. Material referred to as *T. fasciatum* appears to be conspecific to *T. fuentesi* Torre, previously known only from Cuba. Pinto et al. (1978) questionably cited several of the literature references of *T. fasciatum* under *T. exiguum*. The correct citations of these misidentifications are given below in the species synonymy of *T. exiguum* and *T. fuentesi*.

The two species considered here are relatively common east of the Rocky Mountains in North America and are very easily confused. For these reasons we are including a redescription of *T. fuentesi* to complement our earlier description of *T. exiguum* (Pinto et al., 1978). The descriptive data for *T. fuentesi* are based on material from Del Rio, Texas. Intraspecific variation is discussed separately.

The terminology used in our description of male genitalia follows Pinto et al. (1978). Terms used are gonobase (GB), dorsal expansion of gonobase (DEG), median ventral projection (MVP), chelate structures (CS), and chitinized ridge (CR). This terminology was utilized by Nagarkatti and Nagaraja (1968, 1971). Labelled drawings of male genitalia of *Trichogramma* spp. have appeared several times in the literature (e.g., Nagarkatti and Nagaraja, 1968; Nagarkatti, 1973).

Quantitative data in the description include the mean, \pm the standard error, followed by the range and sample size.

Trichogramma fuentesi Torre

Figs. 1a, 1c

Trichogramma fasciatum: Quednau 1960: 32; Flanders 1968: 1122; Nagarkatti and Nagaraja 1971: 20, 1977: 159–168 *passim*; Nagaraja and Nagarkatti 1973: 289; Nagarkatti and Fazaluddin 1973: 103.

Trichogramma fuentesi Torre 1980: 12.

Color in male light yellow to yellow with yellow-brown to black markings. Pronotum, mesoscutum, and coxae yellow brown; abdomen yellow brown to black, darker anteriorly. Females lighter, mesoscutellum yellow, black markings on abdomen not as extensive as in male, confined to lateral and basal areas of sclerites.

Male.—Antennal flagellum relatively long, only slightly arcuate basally, usually slightly longer (subequal to less than 10% longer) than hindtibia; flagellar setae stout, tapering noticeably at apex only, ca. 45 in number; length of longest seta 1.80 ± 0.03 (1.6–1.9) ($n = 10$) as long as maximum flagellar width.

Forewing with vein tracts distinct, setae between tracts relatively sparse, area between 4th and 5th vein tract with 5–27 setae; longest seta on postapical margin of wing ca. 70% longer than maximum width of hindtibia.

Hindwing (Fig. 1a) with posterior and anterior tracts not as prominent as middle tract; posterior tract moderately well developed with setae increasing in length apically and extending $\frac{3}{5}$ to $\frac{4}{5}$ the distance of middle tract; anterior tract consisting of only 1–4 widely spaced setae, extending less than half the distance of middle tract.

Mesoscutellum with anterior pair of setae fine, moderately long, about $\frac{1}{3}$ the length of posterior pair.

Genitalia (Fig. 1c): Genital capsule $0.34 \pm .004$ (.32–.36) ($n = 10$) as wide as long; DEG distinctly narrowed, subacute apically, apex slightly anterior to level of MVP and CS; MVP long, robust, blunt at apex, reaching or almost reaching apex of CS (ratio of the distance from base of genital capsule to apex of MVP to the distance from base of genital capsule to apex of CS = $0.98 \pm .004$ [.96–1.00] [$n = 10$]); CS attaining $0.87 \pm .002$ (.86–.89) ($n = 10$) length of genital capsule. CR distinct at posterior end only, not extending to basal half of genital capsule. Aedeagus slightly longer than apodemes, together $0.87 \pm .01$ (.81–.91) ($n = 10$) as long as hindtibia.

Female.—Ovipositor $1.06 \pm .001$ (1.056–1.060) ($n = 3$) as long as hindtibia. Flagellum short, $0.83 \pm .01$ (.81–.85) ($n = 3$) the length of scape, $0.48 \pm .02$ (.43–.50) ($n = 3$) as wide as long.

Material examined and hosts.— F_3 material originating from Del Rio, Texas, ex. unidentified Noctuidae eggs on *Sonchus* sp. Generations subsequent to the F_1 reared on eggs of *Trichoplusia ni* Hübner at 23–27°C. Additional material includes a collection from Crowley, Louisiana, taken from *Chilo plejadellus* Zincken (Pyralidae) on rice, and two specimens, including a male paratype, from the original series of *T. fuentesi* collected in Cuba from *Diatraea saccharalis* (F.) on sugar cane at the type locality (see below), and at Quivicán, respectively.

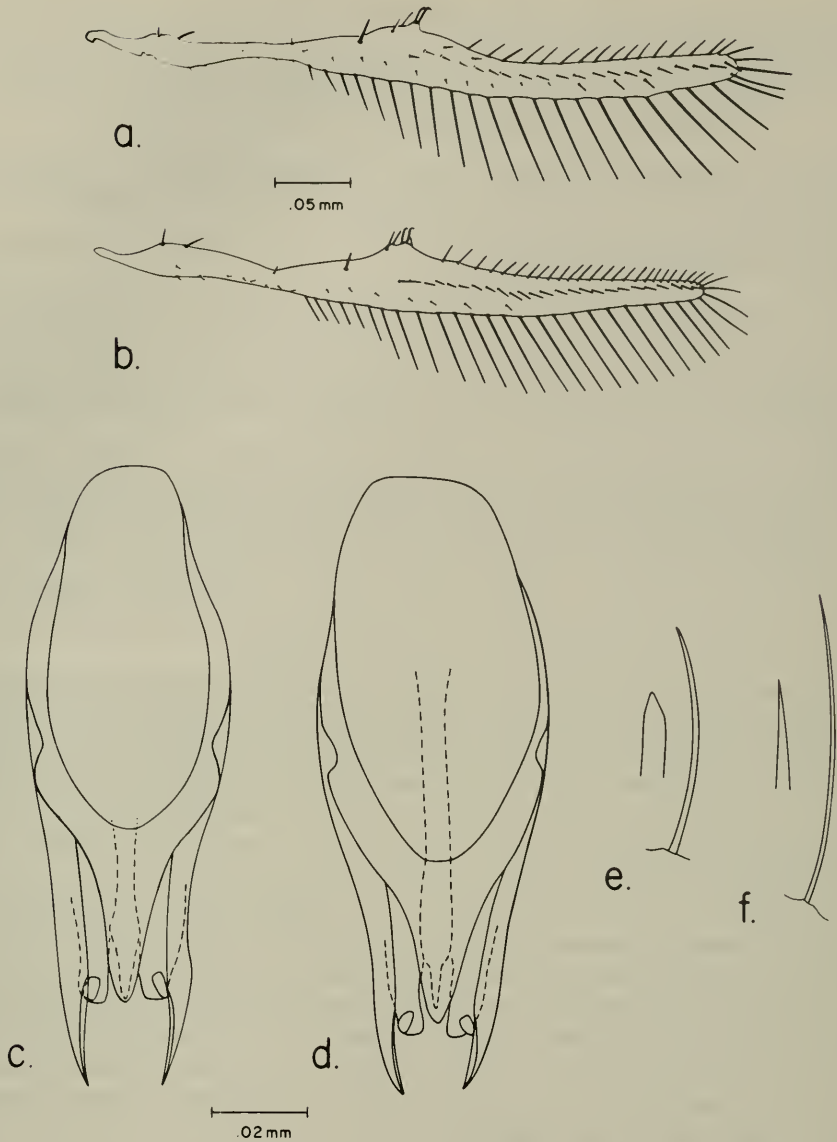


Fig. 1. a, c, *Trichogramma fuentesi*. b, d, e, *T. exiguum*. f, *T. minutum*. a, b, Hindwings. c, d, Genital capsules, dorsal view. e, f, Flagellar setae.

Type information.—Holotype, male?, from material originating at San José de las Lajas, La Habana Province, Cuba; deposited in the Zoology Department collection of the University of Havana, Cuba.

Geographic distribution.—Known from Texas and Louisiana in the United States, and from Cuba. Nagarkatti and Nagaraja (1971) also record this species (as *T. fasciatum*) from Argentina, Barbados, Mexico, and Peru.

Variation.—Torre (1980) recognized two forms of *T. fuentesi* in Cuba. These differ primarily in the color of the host egg (*D. saccharalis*) after parasitization.

The population from the type locality, San José de las Lajas, causes no discoloration of the host egg. Those parasitized by the form from Quivican turn grey with black spots. The two variants also differ slightly morphometrically. The major difference noted is in the length of the hindtibia relative to the combined length of the aedeagus and apodeme. In the type material the latter is ca. 5% longer than the hindtibia; in material from Quivican it is ca. 5% shorter. Individuals intermediate in this and other traits convinced Torre that the two populations are conspecific.

Based on the original description and examination of specimens from the original series, it appears that the U.S. populations studied represent *T. fuentesi*. The hindwing setation was obscured in the two examined specimens from Cuba, but all other distinguishing traits including those of the male genitalia and male antennae match. As with Cuban material, the U.S. specimens are variable in the combined length of the aedeagus and apodemes relative to that of the hindtibia. In specimens from Del Rio the hindtibia is between 10–20% longer; in those from Crowley, Louisiana, it varies from 10% longer to subequal (see below). In none of the U.S. material is the hindtibia shorter, as occurs in the type series.

We have not reared *T. fuentesi* from *D. saccharalis* eggs and cannot comment on their coloration in response to parasitization by U.S. populations. However, those of an unknown species of Noctuidae (Del Rio host) and *Trichoplusia ni* (laboratory host) turn blackish as do most eggs parasitized by *Trichogramma*.

The only character that appears to differ significantly between U.S. and Cuban *T. fuentesi* is ovipositor length. Torre reports the ovipositor to be 1.24 the length of the hindtibia. In our material it averages only 1.06 the hindtibial length. We have not seen females of *T. fuentesi* from Cuba and cannot be sure that Torre is measuring these structures as we are. Nevertheless, ovipositor length is one of the most intraspecifically variable characters in *Trichogramma* and we are reluctant to delimit species on this basis alone.

Specimens from Crowley, Louisiana, are similar to those from Del Rio, Texas, in all respects. Minor differences are the slightly longer setae on the male flagellum ($1.91 \pm .05$ [1.7–2.0] [$n = 9$] as long as maximum flagellar width), the greater combined aedeagus-apodeme length ($0.94 \pm .02$ [.9–1.0] [$n = 9$] the length of the hindtibia), and the slightly longer MVP which reaches the apex of the CS in almost all of the males examined.

Trichogramma exiguum Pinto and Platner

Figs. 1b, 1d, 1e

Trichogramma perkinsi: Nagarkatti and Nagaraja 1971: 23, 1977: 160–169 *passim*; Nagaraja and Nagarkatti 1973: 289.

Trichogramma exiguum Pinto and Platner 1978: 177.

The original description of *T. exiguum* was based on material from Alabama (Selma) and Missouri (Columbia and Springfield). We have since examined material from St. John, Kansas; Krotz Springs, Louisiana; and Palmira, Colombia. All other literature records questionably listed under *T. exiguum* by Pinto et al. (1978) are almost certainly assignable to *T. fuentesi*. Known hosts for *T. exiguum* include five species of Noctuidae: *Diatraea grandiosella* (Dyar), *Heliothis zea* (Boddie), *H. virescens* (F.), *Pseudoplusia includens* (Walker), and *Trichoplusia ni*.

IDENTIFICATION OF *T. EXIGUUM* AND *T. FUENTESI*

Trichogramma exiguum and *T. fuentesi* are superficially similar to *T. minutum*, but are easily distinguished by the shape of the flagellar setae in the male. In *T. minutum*, the setae gradually taper to a fine point (Fig. 1f). In *T. exiguum* and *T. fuentesi*, they are essentially the same diameter most of their length, tapering noticeably at the apex only (Fig. 1e).

Trichogramma exiguum and *T. fuentesi* (as *T. perkinsi* and *T. fasciatum*, respectively) are separated in couplet 9 of Nagaraja and Nagarkatti (1973). The following modification of this couplet adequately separates the two species:

- Male genitalia with median ventral projection attaining or nearly attaining apex of chelate structures, chitinized ridge indistinct except at posterior end, not extending to basal half of genital capsule (Fig. 1c); hindwing with setae of posterior tract increasing in length apically, tract extending $\frac{3}{5}$ - $\frac{4}{5}$ the distance of middle tract (Fig. 1a) *T. fuentesi*
- Male genitalia with median ventral projection distinctly short of apex of chelate structures, chitinized ridge distinct throughout length and attaining basal half of genital capsule (Fig. 1d); hindwing with setae of posterior tract uniformly short, tract not extending more than $\frac{1}{2}$ the distance of middle tract (Fig. 1b) *T. exiguum*

Although less reliable than the above traits, color of adults and the extension of the chelate structures also provide separation. *Trichogramma fuentesi* is a darker species, with dark areas of the body almost black rather than yellow brown as in *T. exiguum*. In *T. exiguum*, the chelate structures approximate the apex of the gonoforceps more closely than in *T. fuentesi* (Figs. 1c, 1d). In four geographically distinct populations of *T. exiguum*, the chelate structures attain $0.91 \pm .002$ (.90-.93; $n = 36$) the length of the genital capsule; in populations of *T. fuentesi*, they only attain $0.87 \pm .002$ (.85-.89; $n = 18$) its length.

Cross-breeding studies support the recognition of *T. exiguum* and *T. fuentesi* as distinct. Attempted crosses between *T. exiguum* from Selma, Alabama, and *T. fuentesi* from Del Rio, Texas, were completely unsuccessful. Procedures used in these cross-breeding studies were as detailed by Oatman et al. (1970).

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